

EAST-WEST MOBILITY STUDY

WORKING PAPER # 4 –DRAFT

EAST/WEST MOBILITY STRATEGY PACKAGES

Prepared for:
Maricopa Association of Governments
Phoenix, Arizona

Prepared by:
Entranco, Inc.
7740 North 16th Street, Suite 200
Phoenix, Arizona 85020

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I. EXECUTIVE SUMMARY

The East-West Mobility Study is one element of the Maricopa Association of Government's (MAG) Regional Transportation Planning Process. The Study area is bounded by Thunderbird / Waddell Road on the north to Northern Avenue on the south; and Loop 303 on the west to State Route (SR) 51 on the east. This Working Paper identifies potential Mobility Strategies available to address east/west mobility within the study area.

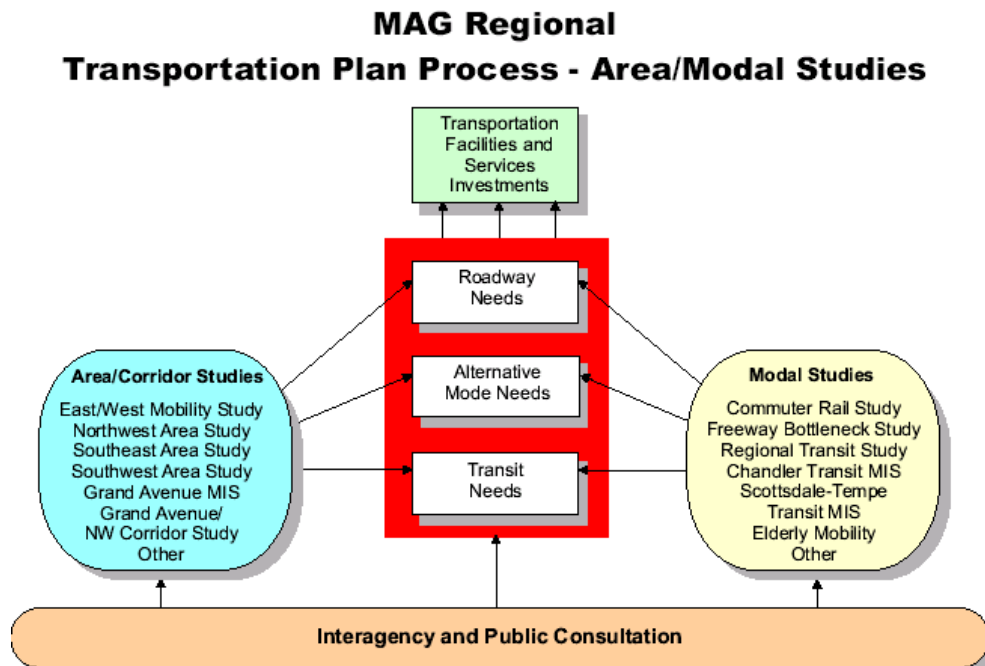
II. INTRODUCTION

The study will assess choices for east-west traffic flow improvements within the project area and will include an assessment of current traffic demands and facility characteristics, estimates of future traffic demands, development of East/West Mobility Strategy Packages, and a screening process that leads to a Preferred East-West Mobility Strategy Package. Mobility strategies developed in this working paper will provide transportation strategies that will ultimately selected for the preferred transportation strategy package.

III. STUDY BACKGROUND

Maricopa County is expected to continue to experience major population increases and is forecast to grow from approximately 3.1 million in 2000 to 4.5 million in 2020. This expected growth is driven by migration from other states and immigration from Latin America. The Regional Transportation Planning Process is intended to address the increased demands associated with these population increases. The East-West Mobility Study is one part of the overall MAG Regional Transportation Planning Process. This process is shown in Figure 1.

Figure 1 – MAG Regional Transportation Planning Process



IV. STUDY AREA

The study area is bounded by Thunderbird / Waddell Road on the north to Northern Avenue on the south; and Loop 303 on the west to SR 51 on the east. Figure 2 shows a map of the study area.

V. OVERVIEW OF THE EAST-WEST MOBILITY STUDY PROCESS

The study will assess mobility strategies for east-west traffic flow improvements within the project area and will include an assessment of current traffic demands and facility characteristics, estimates of future traffic demands, level of service, development of East/West Mobility Strategy Packages, and a screening process that leads to a Preferred East-West Mobility Strategy Package. Evaluation criteria will be developed as the study progresses. This working paper will document the development of transportation strategy packages.

VI. PUBLIC INVOLVEMENT / COORDINATION

Public involvement opportunities will be provided throughout the decision-making process. The Study includes comprehensive agency and public involvement components to ensure active community and governmental agency involvement throughout the study process. Public meetings will be used to present study findings and to solicit public input on project issues, development of mobility strategy packages, and evaluation of these packages and final East/West Mobility Study recommendations.

VII. IDENTIFICATION OF POTENTIAL STRATEGIES

As part of the East/West Mobility Study identification and evaluation of proposed strategies, the consultant team has identified a list of potential strategies for increasing roadway capacity and improving east/west mobility. Based on the characteristics of the study area a screening process will be used to identify those strategies, which are appropriate for the study area.

This study will make an attempt to separate potential strategies into a hierarchical order that considers first those actions that address the fundamental transportation and land use relationships that cause vehicle trips. If the reason for the trip can be eliminated, so can the trip and its contribution to congestion. In successive rounds, the residual trips not mitigated by previous levels of actions are dealt with using techniques aimed at the next higher level of concern. This process is described below:

- **Level One:** Actions that decrease the need for trip making (i.e. land use planning, activity centers, congestion pricing, and some transportation demand management measures).
- **Level Two:** Actions that place trips into transit or other non-auto modes (i.e. public transit capital and operating improvements, and park and ride).
- **Level Three:** Actions that put as many trips as possible into High Occupancy Vehicle (HOV).

- **Level Four:** Actions that optimize the highway system's operation for Single Occupancy Vehicle (SOV) trips, and for all other trips using highway facilities/modes (traffic signalization modification, intelligent transportation systems, etc.).
- **Level Five:** Actions that increase the capacity of major intersections for SOV and all other trips using highway facilities by improving intersections.
- **Level Six:** Actions that increase the capacity of the highway system for SOV and all other trips using highway facilities by adding lanes and improving associated intersections.

Level One Strategies

The first level includes actions that decrease the need for making the trip by vehicle. Level One strategies that may be appropriate for the study area include various land use planning / activity center strategies.

Land use strategies seek to achieve concurrence between transportation infrastructure and land development. These strategies are often viewed as key to the success of any regional transportation plan, and should be analyzed at the regional scale. Land use strategies that can reduce the demand for SOV travel include locating residential or commercial development along transit corridors and mixed-use development. In addition, land use planning practices and activity centers may even eliminate vehicular trips by matching trip productions with attractions at the same site, or by providing good pedestrian, transit and bicycle accessibility. Components of this approach could include:

- Stricter design/zoning standards that promote this strategy (such as density bonuses);
- Maintenance/development of a jobs/housing balance, and
- Mixed-use developments.

Typical keys to success include coordination between land use and transportation planning; the promotion of activity centers; good public information and outreach regarding the benefits of this strategy; an emphasis on providing good pedestrian and bicycle accessibility, internal transit circulation, and permitting mixed use/compact development.

Level Two Strategies

The second level includes actions that attempt to place the trips not addressed in Level One into transit or other non-auto modes. This level of strategies includes capital investments in public transit, public transit operational improvements, intelligent transportation systems, methods to encourage the use of non-traditional modes and certain types of transportation demand management. Level Two strategies that may be appropriate for the study area include: improvements in the Valley Metro service, park and ride facilities, improved access to existing intermodal facilities, ITS applications, and bicycle and pedestrian facilities.

Public Transit Capital Improvements

Transit capital improvements are designed to increase ridership on transit lines by improving transit infrastructure or vehicles. These strategies are generally implemented to address regional or corridor transportation system deficiencies. Potential improvements could include:

- Fleet expansion;
- Vehicle replacement/upgrades;
- Park-and-ride lots, and
- New, expanded, or improved transit stations (intermodal facilities).

The main key to success in implementing any of these strategies is a thorough study and understanding of the complicated issues, which affect the use of non-automobile modes. It is also important to evaluate the entire trip, from origin to destination, when determining the appropriate strategy for shifting vehicle trips away from the personal vehicle. Good intermodal connections are crucial to providing competitive travel times. These transfers should be efficient and often require coordination between the various modes accessing intermodal facilities to minimize transfer times. It is also important to consider the pedestrian element of any trip to achieve the complete evaluation of the entire trip, from origin to destination. The convenience of alternatives is important, such as the proximity/access of transfer points and the reliability of the system.

Public Transit Operational Improvements

Like capital improvements, operational improvements to the transit system can increase the demand for transit, which reduces the number of vehicles on the road. Operational improvements can be implemented on specific routes or within transit corridors, although regional operational improvements are commonly developed. Some strategies are:

- Increases in service frequency;
- Longer operating hours;
- Additional bus routes;
- Restructured or extended bus lines;
- Fare reductions; and
- Improvement of coordination and transfers between systems and routes.

Several of the operational improvements may require the addition or reallocation of resources to allow for increased service frequencies, hours of operation, additional routes, extensions of current routes, or even farebox reductions on routes. It is important to conduct studies to determine the impact on ridership and the financial implications of the changes.

Advanced Public Transportation Systems

Advanced Public Transportation Systems (APTS) are a type of Intelligent Transportation System (ITS), and include coordinated operational strategies implemented through technology. Intelligent bus stops and advanced mode choice systems can be used to provide up-to-date travel information to transit patrons.

As with any new technology, its effectiveness often hinges on public education and outreach to create user-friendly systems. To be effective, these information systems should provide data on multiple factors, which affect the trip making decision. This typically requires multi-agency coordination to identify traffic conditions created by incidents, or just the current extent of congestion. Elements may include:

- *Travel Planning.* Pre-trip multi-modal travel information and ride-matching services can help travelers determine their optimal mode choice, departure time, and route before their trips.
- *Traveler Information.* Real-time information to guide travelers during trips includes advisory services (to warn of traffic or transit congestion or delays), route guidance systems, and traveler services information.

Non-Motorized Modes

In many areas, walking and bicycling are a viable alternative to vehicle use. In some cases, improving the transportation system to better accommodate pedestrians and bicyclists can increase demand for these non-traditional modes. The scale of these measures ranges from a regional approach (i.e., land use strategies) to facility-specific improvements (i.e., bicycle paths). Strategies that can be used include:

- New pedestrian and bicycle facilities;
- Improved facilities (safety, aesthetic, or travel time improvements), and
- Bicycle storage systems can be installed at transit terminals, on transit vehicles and at work sites.

The keys to these types of improvements include adequate planning to ensure the facilities are effectively implemented within the overall land use plan and transportation system, and public education and outreach to ensure the implemented improvements are consistent with public desires. Often, multi-agency coordination is required to achieve the level of planning needed to fully integrate these strategies within the highway and transit systems.

Level Three Strategies

The third level includes actions that attempt to place the trips into high occupancy vehicles (HOV) and includes various strategies, which encourage HOV use and certain types of transportation demand management. Level Three strategies that may be appropriate for the study area include: guaranteed ride home programs and rideshare matching services.

Level Four Strategies

Despite the best possible results from strategies in the first three levels, a significant portion of trips on the major arterials will remain via the automobile. The fourth level includes actions to optimize the existing highway system's operation for automobile trips, whether HOV or SOV, and includes traffic operational improvements and management, access management and intelligent transportation systems. Level Four strategies that may be appropriate for the study area include: various traffic operational improvements and management, truck restrictions, access management and ITS applications.

Traffic Operational Improvements

Improvements in traffic operations are designed to allow more effective management of the supply and use of existing roadway facilities. These improvements can increase effective capacity by optimizing traffic operations, especially in recurring congestion conditions. Although some of these strategies may involve the construction of additional lanes, this category encompasses improvements intended to help "optimize" existing capacity on the road system, as opposed to "adding" new capacity. Depending on the specific strategy, traffic operations improvements can be appropriate for a region, corridor, or specific facility. Some strategies can include:

- Signal synchronization and coordination. Traffic control centers, including coordinated signal systems on arterials, and regional control centers with communication systems to interconnected signal systems;
- Advanced traffic surveillance and control centers allow monitoring, dynamic updates to signal systems, and coordinated traffic signal control and can be used to support incident management and traveler information activities;
- Directional bias/reversible lanes;
- Roadway widening, including auxiliary lanes, passing lanes, and widened shoulders, and
- Truck restrictions to increase roadway capacity.

The main key to success for each of these strategies is thorough engineering studies to identify the appropriate strategy, and the application of appropriate engineering criteria in the design of the improvements. Another important factor is adequate maintenance of traffic signals and loops to ensure the system operates efficiently. Some of these strategies, such as truck restrictions, require public education and outreach.

Access Management

These strategies are designed to improve arterial flow by controlling access to and from arterial roadways. ADOT as well as local government agencies have developed standards, which govern road design and driveway connections. However, local governments within the study area may wish to enforce more strict access management criteria through the site plan review process. Access management strategies can be used to plan for:

- Driveway control (residential and business); and
- Median control.

Each of these strategies requires the appropriate application of accepted engineering criteria. For new developments, this access control can be implemented during the permitting process. Retrofitting existing roadways typically requires studies to identify the impact of proposed changes and the identification of alternate access opportunities. Public outreach and education can be beneficial when implementing access control, with special attention placed on property directly impacted.

Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) include coordinated operational strategies implemented through technology. These systems can be applied to many of the strategies described above, especially in the areas of traffic operations, transit operations, and incident management. In addition, ITS can be applied throughout a region, along a transportation corridor, or on a specific facility. Samples of ITS effective at improving highway operations include:

Advanced Traveler Information Systems (ATIS), which may include:

- *Travel Planning.* Pre-trip multi-modal travel information and ride matching services can help travelers determine their optimal mode choice, departure time, and route before their trips;
- *Traveler Information.* Real-time information to guide travelers during trips includes advisory services (to warn of traffic or transit congestion or delays), route guidance systems, and traveler services information;

One of the keys to success for implementing ITS strategies is the availability of affordable, proven technology. Some ITS strategies, such as advanced traveler information systems, require multi-agency coordination.

Level Five Strategies

The fifth level includes actions to optimize existing intersections and the traffic operations of the intersections. Intersections are usually the congestion point of a transportation corridor. The individual intersection is of the utmost importance in overall arterial traffic flow. Selected intersection improvement can help improve the overall mobility with a corridor. Level Five strategies that may be appropriate for the study area include: various intersection geometric improvements and intersection traffic operation improvements.

Improvements in traffic operations are designed to allow more effective management of the supply and use of existing intersection and approaching roadway facilities. These improvements can increase effective capacity by optimizing traffic operations, especially in recurring congestion conditions. Although some of these strategies may involve the construction of additional lanes, this category encompasses improvements intended to help "optimize" existing capacity on the transportation system, as opposed to "adding" new capacity. Traffic operations and intersection improvements will be appropriate for individual intersections. Strategies can include:

- Intersection geometric improvements, additional right or left turn lanes or minor widening to increase turning movement capacity, restriping, and channelization;
- Intersection turn restrictions to eliminate conflicting movements;
- Signing improvements;
- Traffic signal improvements, such as adjustments to signal timing and phasing, and the installation and maintenance of actuated system components (i.e. loops and controllers); and
- Approach roadway widening, including auxiliary lanes, passing lanes, and widened shoulders.

The main key to success for each of these strategies is thorough engineering studies to identify the appropriate strategy, and the application of appropriate engineering criteria in the design of the improvements. Another important factor is adequate maintenance of traffic signals and loops to ensure the system operates efficiently. Some of these strategies, such as turn and truck restrictions, require public education and outreach.

Level Six Strategies

The sixth level includes strategies to increase the capacity of the highway system by providing additional general-purpose lanes and grade separated intersections. Based on this strategy, adding general-purpose lanes to major arterials within the identified study area is an appropriate strategy.

Addition of General Purpose Lanes

General-purpose lanes may be used by all vehicular traffic modes (i.e. SOV, HOV, transit, and trucks). As defined in this study, the addition of general-purpose lanes may include the addition of lanes to an existing facility. These infrastructure improvements may be the best approach to congestion management in some cases, as long as appropriate elements of the other strategies are incorporated into the design and operation of the expanded facility. It should also be noted that several measures that would increase the number of general-purpose lane miles are also identified under traffic operational improvements (Level Four). The improvements in that section generally refer to smaller scale additions (i.e., turn lanes) or those for specific purposes (i.e., passing lanes).

Grade Separated Intersection

A grade-separated intersection occurs when intersecting roads are separated in level to eliminate crossing conflicts. The roads no longer intersect at the same grade (i.e. the intersection is no longer an at-grade intersection) and so the intersection is referred to as being grade separated. If the intersection also allows turning movements from one road to another, then an interchange is formed. An interchange is the highest form of intersection treatment. When fully developed all at-grade crossing is eliminated and interaction between traffic streams takes place by merging, diverging or weaving.

The advantages of grade separation and interchanges are:

- Capacity approaches that of normal road sections;
- Increased safety and driver comfort;
- Design is flexible – they can be adapted to most situations; and
- Staged development is often possible.

The disadvantages of grade separations and interchanges are:

- Costly;
- Large land area required; and
- May be confusing to drivers.
- Has major impact on adjacent development and may reduce property access

STRATEGY SCREENING

With such an extensive list of potential strategies identified, it is desirable to perform an initial screening to determine which strategies are applicable for a given deficiency. Therefore, screening produces a more efficient process by eliminating the analysis of strategies, which are not applicable for a given deficiency.

Based on this strategy screening analysis, a number of strategies were found to be applicable to the East/West Mobility Study area. The applicable strategies are summarized in the Table 1 below.

Table 1
Applicable Strategies

Level	Strategy
1	Land use policies/regulations
2	Bus fleet expansion
2	Transit park and ride facilities
2	Other intermodal facilities
2	Transit service enhancement / expansion
2	Transit operational improvements
2	Bicycle/ Pedestrian facilities
2	Installation of bus bays
4	Computerized signal system
4	Access/driveway control
4	Median control and turn restrictions
4	Truck restrictions
4	Intelligent Transportation System (ITS)
5	Intersection geometric improvements
5	Signalization improvements
5	Signing improvements
5	Intersection turn restrictions
6	Add general purpose arterial lanes
6	Grade separated intersections

VIII. MOBILITY STRATEGY PACKAGES

After the existing conditions of the study area were identified and analyzed, the strategy package development process began. The culmination of the existing conditions efforts was documented in *Working Paper #2 Current Study Area Conditions and Mobility Issues*. The first step in the strategies development process is to identify potential strategies that would address the deficiencies identified in the current study area conditions report. These strategies are identified and documented above in Section VII. *Identification of Potential Strategies*. Specific packages incorporating applicable strategies will be developed here in Section VIII.

The starting point for any comparative analysis is the “No-Build.” The “No-Build” is the baseline for all comparative analysis and evaluations. Three major scenarios were then developed to help solve the east/west mobility concerns discussed in *Working Paper #2 Current Study Area Conditions and Mobility Issues*. The No-Build, Strategy Packages 1, 2, and 3 are presented below. In addition, area connectivity issues and future needs in developing areas are discussed.

In addition, it should be noted that the MAG Grand Avenue Northwest Corridor Study is in the process of being completed. The East/West Mobility Study will be consistent and coordinate with the findings and recommendations of the Grand Avenue Northwest Corridor Study by including proposed improvements that fall within the East/West Mobility study area.

NO-BUILD:

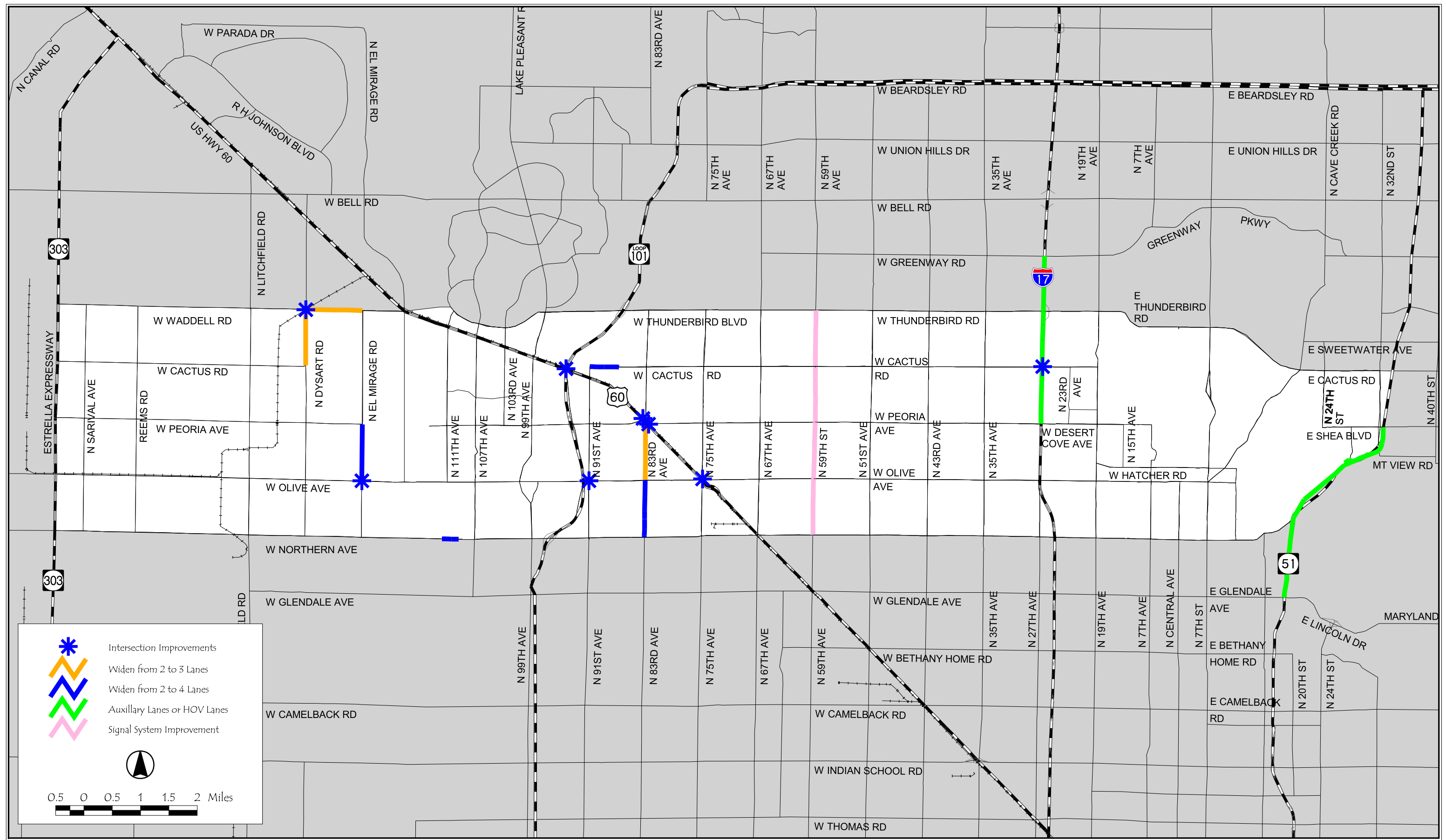
This scenario assumes that no roadway or intersection capacity improvements, or multi-modal improvements will be made beyond the currently adopted Transportation Improvement Program (TIP). The roadway, intersection, and multi-modal facilities will remain, as they exist with just the TIP projects included. The existing intersection geometry will be maintained as well as the existing bus routes and service hours and bicycle/pedestrian facilities.

For reference, **Figure 3** shows existing number of lanes on major streets in the study area and **Figure 4** indicates improvements in the MAG 2002-2006 TIP.

STRATEGY PACKAGE #1: TRANSIT, BICYCLE/PEDESTRIAN/ INTELLIGENT TRANSPORTATION SYSTEM (ITS), AND SIGNAL COORDINATION

Strategy Package #1 would maintain the existing roadway and intersection configurations. This package is highlighted by transit, bicycle/pedestrian, intelligent transportation system, and signal coordination improvements. Strategy Package #1 primarily utilizes the concepts identified in Levels 1-5 described in Section VII.

This package would include transportation opportunities that would improve overall mobility with an emphasis on non-roadway capacity features. Local bus service would be extended west to Loop 303 on Thunderbird Road/Waddell Road, Olive Avenue, and Northern Avenue. New local bus service would be placed on 67th Avenue, 75th Avenue 83rd Avenue, 91st Avenue, 99th Avenue, 107th Avenue, El Mirage Road, Dysart Road, and



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FIGURE 4:
Transportation Improvement Program FY 2002-2006
East-West Mobility Study

Litchfield Road. A new circulator route would be located on 59th Avenue between north of Peoria Avenue to south of Northern Avenue. Finally this package suggests extending express route service on Thunderbird Avenue from 51st Avenue to Loop 101, on Northern Avenue from 43rd Avenue to Loop 101, and with a new express route service on Loop 101 from north of Thunderbird Road to south of Northern Avenue. With these transit improvements, the bus fleet would need to be replaced, upgraded, or expanded and the need for additional park and ride facilities examined further. The transit operating services hours and actual bus route headways or frequencies would need to be considered, with possible increases in the operating hours and decreases in the headways. With the increase in transit service and the expansion of pedestrian and bicycle facilities there could be a potential for a multi-modal transfer center with the following modes having access to one another: express bus, local bus, pedestrian, and bicycle. We have selected two potential sites for a transit transfer center combined with a park and ride facility. One location would be at Grand Avenue/83rd Avenue/Peoria Avenue and the second location would be in the Loop 101/99th Avenue/Northern Avenue area.

This package suggests expanding pedestrian and bicycle facilities wherever possible. With any roadway expansion or roadway-widening project, design standards should be in place to incorporate adequate sidewalks and bicycle lanes. Special attention should be taken to connect employment/work center with residential neighborhoods with adequate pedestrian and bicycle facilities. Major crossing treatments would be used for pedestrian as well as bicycle facilities for both effectiveness and safety reasons. The intent is to place a higher level of multi-modal emphasis on the study area.

Intelligent Transportation System (ITS) improvement includes but not limited to the follow: installation and maintenance of an urban traffic control system; planning deployment, operation and management of a Freeway Management System; motorist information system; and area wide ITS deployment. It is important that ITS architecture and standards be considered in the planning stages as well during the design. ITS is not normally viewed as adding capacity to raise the level of service of the transportation system, but rather to improve/maximize the operation and safety of the facility. In addition, unlike capacity improvements which are facility and segment specific, ITS must be viewed from an overall system perspective. Individual ITS improvements on a facility may not be effective unless they are integrated into an overall ITS system for the entire area. ITS technologies can be a valuable tool by:

- Providing enhanced real-time traffic information and data for transportation planning purposes.
- Providing an overall improvement and operational framework for the system that local municipalities and private sector can participate in.
- Collect and transmit transportation information on conditions and transit schedules for travelers before and during their trips. Alerted to hazards and delays, travelers can change their plans to minimize inconvenience and additional congestion bottlenecks on the system.
- Provide real time message boards to clear traffic accidents or incidents and re-route traffic.
- Decrease congestion by reducing the number of traffic incidents, clearing them more quickly when they occur, and rerouting traffic flow around them.
- Assist drivers in reaching a desired destination with navigation systems enhanced with path finding, or route guidance.

The cities of Glendale and Phoenix and Maricopa County Department of Transportation have systems of synchronized signals. Almost 85 percent of all the traffic signals within the Phoenix metropolitan area are synchronized. The three government agencies have traffic management centers and synchronize their individual signal systems with adjacent cities. In general the systems are synchronized to accommodate travel to and from downtown Phoenix. In the AM peak the signals are coordinated for southbound and eastbound travel while in the PM peak the signals are coordinated for northbound and westbound travel. A coordinated signal system can increase the capacity of a corridor and specific intersections. By maintaining the synchronization and coordination of the signals along Thunderbird Road, Cactus Road, Peoria Avenue, Olive Avenue, and Northern Avenue each corridor would be remain efficient and would maintain overall existing capacity. With the addition of any new signals the following specific corridor segments should maintain signal coordination:

- Thunderbird Road from 59th Avenue to SR 51
- Cactus Road from 83rd Avenue to 19th Avenue
- Peoria Avenue from Grand Avenue to 19th Avenue
- Olive Avenue from Grand Avenue to 7th Street
- Northern Avenue from Grand Avenue to SR 51

These corridor segments were chosen because of the existing and projected congestion and the approximate close signal spacing. The actual adjustments to the coordinated signal system will need to be further studied. **Figure 5** displays Strategy Package #1. A summary of Package # 1 improvements is listed below:

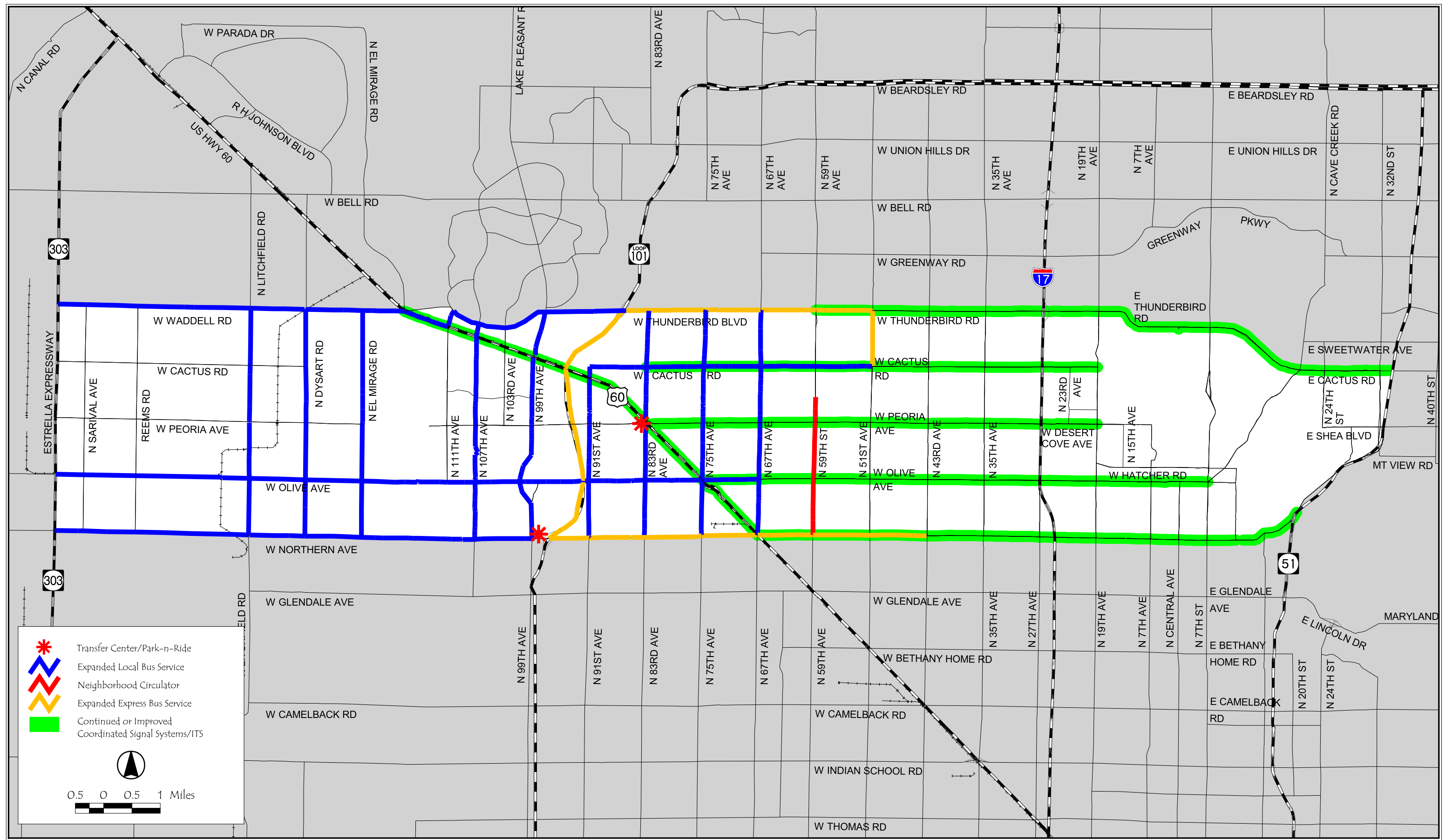
Roadway: Maintain existing through lanes on arterial facilities.

Maintain coordinated signals system along the following roadways:

- Thunderbird Road from 59th Avenue to SR 51
- Cactus Road from 83rd Avenue to 19th Avenue
- Peoria Avenue from Grand Avenue to 19th Avenue
- Olive Avenue from Grand Avenue to 7th Street
- Northern Avenue from Grand Avenue to SR 51
- Grand Avenue from Thunderbird Road to Northern Avenue

Include opportunities for ITS technologies on the following facilities:

- Thunderbird Road from 59th Avenue to SR 51
- Olive Avenue from Grand Avenue to 7th Street
- Northern Avenue from Grand Avenue to SR 51
- Grand Avenue from Thunderbird Road to Northern Avenue



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FIGURE 5:
Strategy Package 1
Transit, ITS, and Alternative Modes
East-West Mobility Study

Intersections: Maintain existing intersection geometry and configuration.

Multi-Modal:

- Emphasis on bus service (express, local, and circulator) with increased route coverage; longer service hours; and new vehicles.
- Emphasis on on-road and off-road bicycle facility improvements including major crossing treatments.
- Emphasis on pedestrian facility improvements including the following: neighborhood-to-neighborhood connections, major pedestrian crossing treatments and multi-modal transfer centers.
- Two Park-and-Ride/Transfer Centers located near Grand Avenue/83rd Avenue/Peoria Avenue and close to Northern Avenue/Loop 101/99th Avenue.

STRATEGY PACKAGE #2: INTERSECTION IMPROVEMENTS

Strategy Package #2 enhances the capacity of the existing roadway system by incorporating intersection improvements such as new or additional left and right turn lanes, lane widening, improved signal timings and phasing, and improved signal progression along the major east/west corridors.

Strategy Package #2 corresponds primarily to the concepts covered under Level Five in Section VII. The intersection level-of-service (year 2020 PM peak hour), year 2020 approach volume, and year 2020 volume/capacity level-of-services for these same approach links were examined within the study area. The intersections identified in Package #2 were those have a failing (E/F) level-of-service for the year 2020 in the PM peak hour conditions and failing (E-F) approach link level-of-service. Thirty-one (31) intersections were identified for improvements. **Table 2** shows the intersections suggested for improvements. **Figure 6** displays Strategy Package #2. A summary of Package #2 transportation improvements are listed below:

Roadway: Maintain existing arterial facilities.

Intersections: Improvements to 31 intersections:

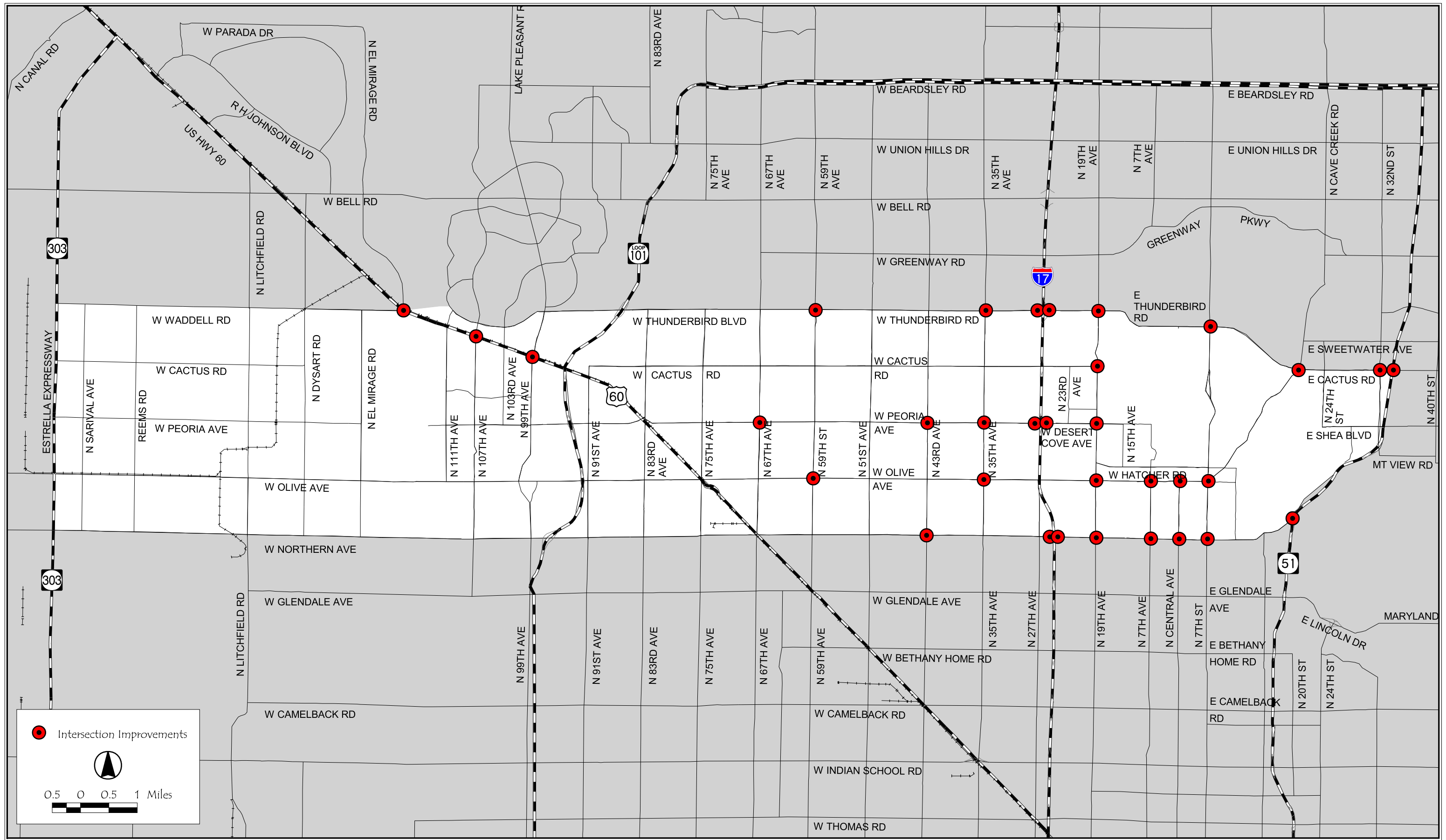
Multi-Modal: Maintain existing bus service (express and local), on-road and off-road bicycle facilities, and pedestrian facilities.

Table 2
Intersection Improvements

Intersection Location	Year 2020 PM Peak LOS
Thunderbird Blvd. / 59 th Avenue	E/F
Thunderbird Blvd. / 35 th Avenue	E/F
Thunderbird Blvd. / I-17 (SB & NB Ramps)	E/F
Thunderbird Blvd. / 19 th Avenue	E/F
Thunderbird Blvd. / 7 th Street	E/F
Cactus Avenue / 19 th Avenue	E/F
Cactus Avenue / Cave Creek Road	E/F
Cactus Avenue / 32 nd Street	E/F
Cactus Avenue / State Route 51	E/F
Peoria Avenue / 67 th Avenue	E/F
Peoria Avenue / 43 rd Avenue	E/F
Peoria Avenue / 35 th Avenue	E/F
Peoria Avenue / I-17 (SB & NB Ramps)	E/F
Peoria Avenue / 19 th Avenue	E/F
Olive Avenue / 59 th Avenue	E/F
Olive Avenue / Dunlop Avenue / 35 th Avenue	E/F
Olive Avenue / Dunlop Avenue / 19 th Avenue	E/F
Olive Avenue / Dunlop Avenue / 7 th Avenue	E/F
Olive Avenue / Dunlop Avenue / Central Avenue	E/F
Olive Avenue / Dunlop Avenue / 7 th Street	E/F
Northern Avenue / 43 rd Avenue	E/F
Northern Avenue / I-17 (SB & NB Ramps)	E/F
Northern Avenue / 19 th Avenue	E/F
Northern Avenue / 7 th Avenue	E/F
Northern Avenue / Central Avenue	E/F
Northern Avenue / 7 th Street	E/F
Northern Avenue / State Route 51	E/F
Grand Avenue / Thunderbird	*
Grand Avenue / 107 th Avenue	*
Grand Avenue / 99 th Avenue	E/F
Grand Avenue / 67 th Avenue	E/F

Source: MAG - Year 2020 PM Peak Hour Assignment Model Run (Scenario 600)

* Draft Working Paper #8 MAG Grand Avenue / NW Study



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FIGURE 6:
Strategy Package #2
Intersection Improvements
East-West Mobility Study

STRATEGY PACKAGE # 3A: STREET WIDENING

This package focuses on roadway/street widening improvements and does not include TSM, intersection, or multi-modal enhancements. However, intersections would be widened, as needed, to accommodate additional approach lanes. Strategy Package #3A (3B and #3C) utilize concepts under Level Six in Section VII. Strategy Package #3A would increase roadway capacity by expanding Northern Avenue by one-lane in each direction from Loop 303 to 107th Avenue and adding an additional westbound lane only from 107th Avenue to 59th Avenue. Olive Avenue would be expanded by two additional lanes in each direction from Loop 303 to El Mirage Road and adding one-lane in each direction from El Mirage Road to 67th Avenue. Waddell Road would be expanded one-lane in each direction from Loop 3030 to Grand Avenue. Thunderbird Road would be expanded by one-lane in each direction from 35th Avenue to 19th Avenue. Cactus Road has one segment that would be expanded by one-lane in each direction from 91st Avenue to 83rd Avenue. Peoria Avenue has two segments that would be expanded by one-lane in each direction from Litchfield Road to Dysart Road and from 107th Avenue to 99th Avenue.

The following north/south roadway would be expanded by one-lane in each direction: 99th Avenue from Olive Avenue to Northern Avenue, 91st Avenue from Cactus Road to Peoria Avenue, and 59th Avenue from Peoria Avenue to Northern.

These suggested roadway-widening projects are consistent with Maricopa Association of Government's currently adopted Long Range Transportation Plan. The roadway segments identified for additional lanes were determined by examining the future travel demand projections against existing roadway capacity. Where the travel demand exceeded the existing capacity additional lanes were recommended.

The Grand Avenue Northwest Corridor Study is in the process of being completed. As of the date of this Working Paper the following recommendations within the East/West Mobility Study area have been suggested:

Grand Avenue / NW Study (Draft Recommendations)

- Intersection improvements at Thunderbird Road, 107th Avenue and 99th Avenue (See Strategy Package # 2)
- Widen Grand Avenue to six-lane through lanes and provide exclusive turn lanes at signalized intersections between Loop 101 to Loop 303 (See Strategy Package # 3A).
- Extend El Mirage Road /Thompson Ranch Road south from Grand Avenue to Olive Road as a 4-lane arterial (See Strategy Package #3A).
- Grade separation at 103rd Avenue (see Strategy Package #3B).

The East/West Mobility Study will be consistent and coordinate with the findings and recommendations of the Grand Avenue Northwest Corridor Study by including proposed improvements that fall within the East/West Mobility study area.

All of the suggested improvements in Strategy Package #3A would provide additional vehicle capacity that results in higher traffic volumes on each of the corridors. The

increase in traffic volumes would be offset by the additional capacity. **Figure 7** displays Strategy Package #3A. A summary of Package #3A improvements are listed below:

Roadway:

Roadway and intersection capacity improvements:

One (1) additional lane in each direction:

- Waddell Road from Loop 303 to Grand Avenue
- Thunderbird Road from 35th Avenue to 19th Avenue
- Cactus Road from 91st Avenue to 83rd Avenue
- Peoria Avenue from Litchfield Road to Dysart Road
- Peoria Avenue from 107th Avenue to 99th Avenue
- Olive Avenue from El Mirage Road to 67th Avenue
- Northern Avenue from Loop 303 to 107th Avenue
- 99th Avenue from Olive Avenue to Northern Avenue
- 91st Avenue from Cactus Road to Peoria Avenue
- 59th Avenue from Peoria Avenue to Northern
- Grand Avenue from Waddell Road to 103rd Avenue
- Grand Avenue from Loop 101 to 75th Avenue/Olive Avenue

Two (2) additional lanes in each direction:

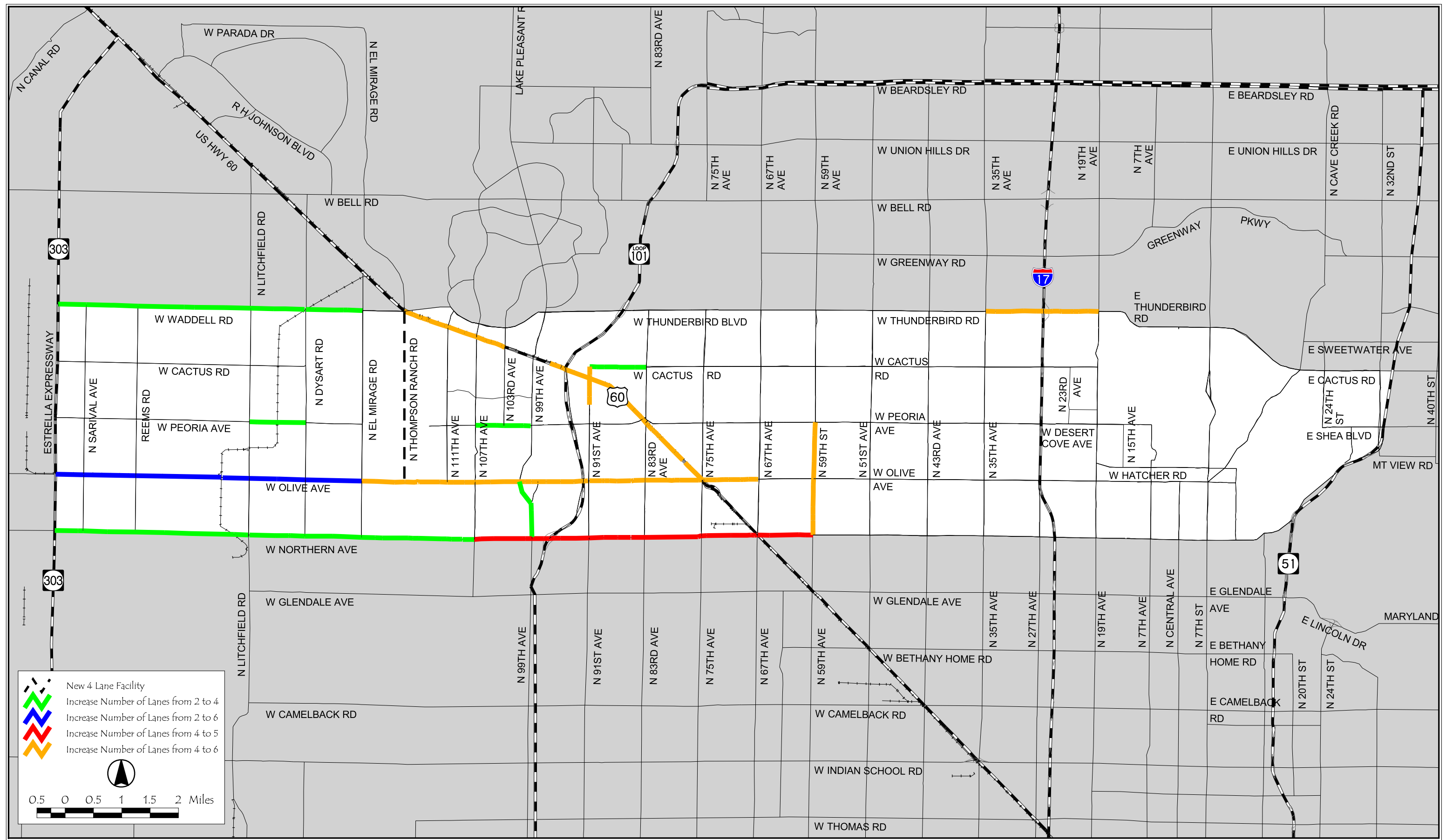
- Olive Avenue from Loop 303 to El Mirage Road

One (1) additional lane westbound only:

- Northern Avenue from 107th Avenue to 59th Avenue
- Widen Grand Avenue to six-lane through lanes and provide exclusive turn lanes at signalized intersections between Loop 101 to Loop 303
- Extend El Mirage Road /Thompson Ranch Road south from Grand Avenue to Olive Road as a 4-lane arterial

Intersections: Maintain existing intersection geometry and configuration. (Intersections would be widened, as necessary, to accommodate additional approach lanes.

Multi-Modal: Maintain existing bus service (express and local), on-road and off-road bicycle facilities, and pedestrian facilities.



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FIGURE 7:
Strategy Package #3A
Street Widening
East-West Mobility Study

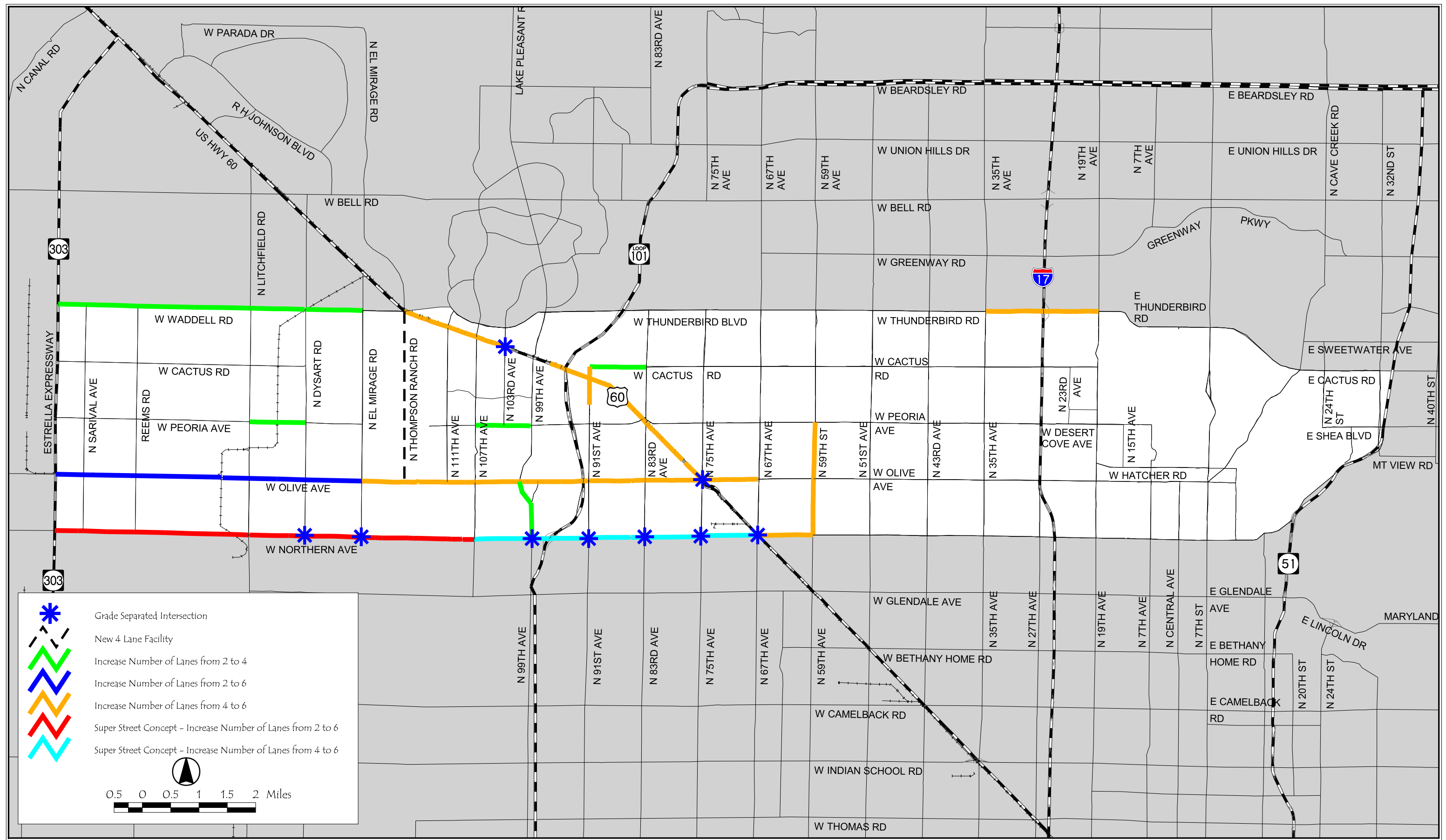
Strategy Package #3B: Street Widening With Northern Avenue “Super Street”

The possibility of a single continuous roadway was looked at for east/west mobility within the identified study area. Thunderbird Road/Waddell Road, Cactus Road, and Peoria Avenue were not possible because of physical and/or geographic barriers (Shaw Butte Recreation Area, North Mountain Recreation Area, Dreamy Draw Recreation Area, and Sun City.) The only east/west continuous corridors remaining are Olive Avenue and Northern Avenue. In 2001 the City of Glendale successfully passed a sale tax increase to pay for transportation improvements. Northern Avenue was identified by the City of Glendale for major transportation improvements.

Strategy Package #3B is the same as Package #3A with one additional project, which is the “Super Street” concept. This concept would increase roadway capacity by expanding Northern Avenue to a high capacity roadway (6-lanes) from Loop 303 to Grand Avenue. Grade separated intersections are suggested at the following locations: Northern Avenue at 75th Avenue, Northern Avenue at 83rd Avenue, Northern Avenue at 91st Avenue, Northern Avenue at 99th Avenue, Northern Avenue at El Mirage Road, and Northern Avenue at Dysart Road. By the year 2020, each of these crossroads will be carrying 20,000 vehicles per daily or more. The projected 2020 daily traffic volumes on Northern Avenue between Grand Avenue and Loop 303 ranges from a low of 6,900 vehicles near Reems Road to a high of 42,900 vehicles just west of Loop 101.

The Northern Avenue improvements in Strategy Package #3B would provide significant additional vehicle capacity that would results in higher traffic volumes on Northern Avenue. Also shown in Strategy Package #3B are grade separations proposed in the Draft MAG Grand Avenue / NW Study and included in the ADOT Life-Cycle MAG Area Freeway Program. **Figure 8** displays Strategy Package #3B. A summary of Package #3B improvements are listed below:

- Roadway: Roadway capacity improvements:
- Same as Package #3A with the following additional improvements:
 - Northern Avenue from Loop 303 to Grand Avenue: Expand to a 6-lane arterial facility with grade separated intersections at the following locations:
 - Northern Avenue at 75th Avenue
 - Northern Avenue at 83rd Avenue
 - Northern Avenue at 91st Avenue
 - Northern Avenue at 99th Avenue
 - Northern Avenue at El Mirage Road
 - Northern Avenue at Dysart Road
 - Grand Avenue at Olive Avenue (ADOT Life-Cycle Program)
 - Grand Avenue at Northern Avenue (ADOT Life-Cycle Program)
 - Grade separation at 103rd Avenue (Draft MAG Grand Avenue / NW Study)



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FIGURE 8:
Strategy Package #3B
Street Widening With Northern Avenue Super Street
East-West Mobility Study

Intersections: Maintain existing intersection geometry and configuration. (Intersections would be widened, as necessary, to accommodate additional approach lanes.

Multi-Modal: Maintain existing bus service (express and local), on-road and off-road bicycle facilities, and pedestrian facilities.

Strategy Package #3C: Street Widening with Northern Avenue “Super Street” and Olive Avenue Emphasis

This package identifies Olive Avenue and Northern Avenue as east-west mobility corridors able to handle large volumes of traffic from Loop 303 to I-17 in the study area. These two corridors also offer a high level of connectivity throughout the entire study area. Each of the previous Strategy Packages in the “#3 series” has built upon the preceding one. Strategy Package #3C is developed in sequence by building upon the previous Strategy Packages (#3A and #3B).

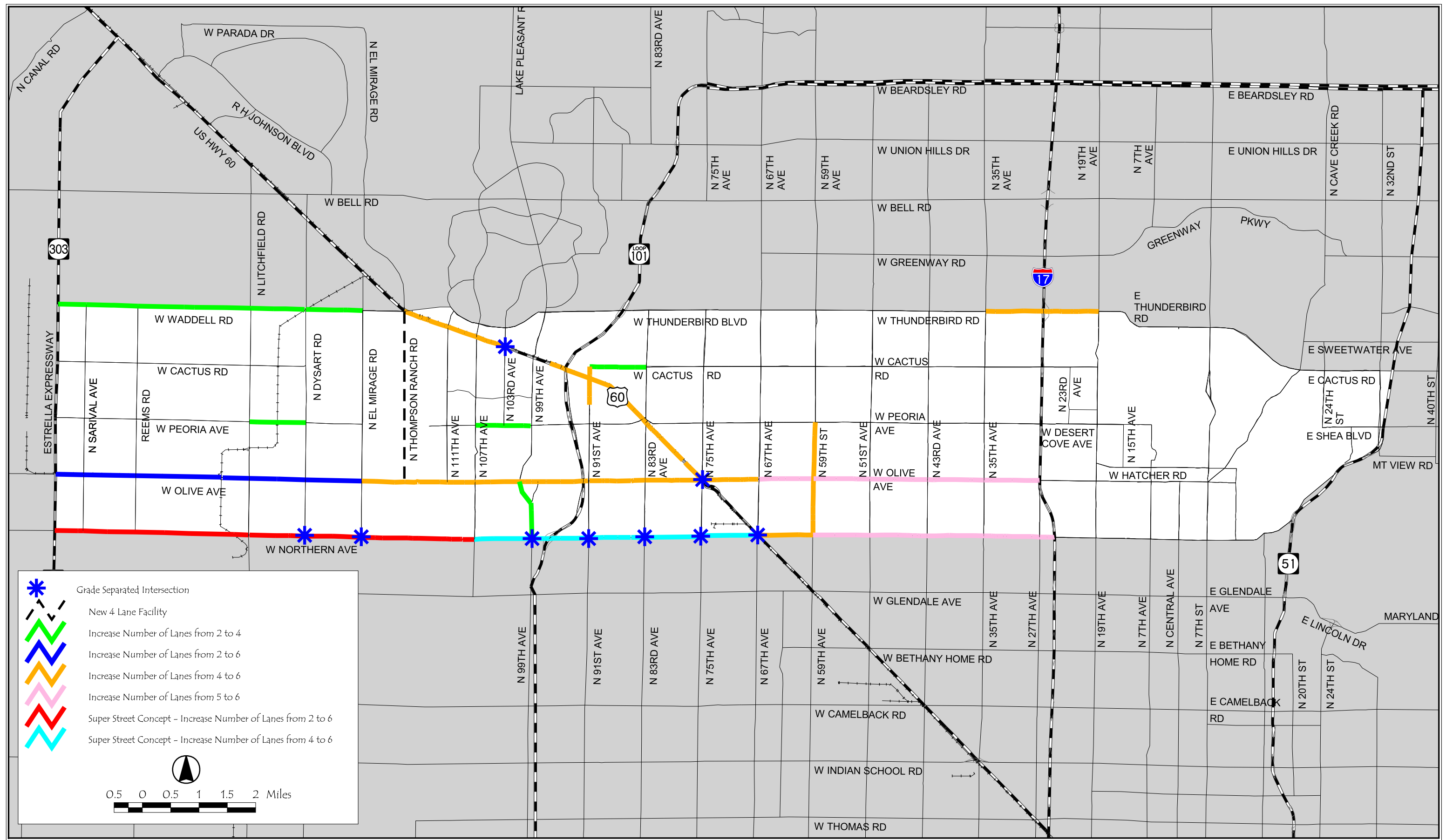
Strategy Package #3B expanded Olive Avenue to a 6-lane facility from Loop 303 to 67th Avenue and expanded Northern Avenue to a “Super Street” 6-lane facility from Loop 303 to 59th Avenue. Strategy Package #3C is the same as Package #3B with additional through lane capacity on Olive Avenue and Northern Avenue. This concept would continue the 6-lane concept of Olive Avenue and Northern Avenue to I-17. Strategy Package #3C increases roadway capacity by expanding Northern Avenue from a 5-lane facility to a 6-lane facility from 59th Avenue to I-17 and Olive Avenue would be expanded from a 5-lane facility to a 6-lane facility from 67th Avenue to I-17. The Olive Avenue and Northern Avenue improvements in this strategy package would provide additional vehicle capacity. **Figure 9** shows Strategy Package #3C. A summary of Package #3C improvements are listed below:

Roadway: Roadway capacity improvements:

- Same as Package #3B with the following additional improvements:
 - Olive Avenue from 67th Avenue to I-17: Expand to a 6-lane arterial
 - Northern Avenue from 59th Avenue to I-17: Expand to a 6-lane arterial

Intersections: Maintain existing intersection geometry and configuration. (Intersections would be widened, as necessary, to accommodate additional approach lanes.

Multi-Modal: Maintain existing bus service (express and local), on-road and off-road bicycle facilities, and pedestrian facilities.



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FIGURE 9:
Strategy Package #3C
Street Widening With Northern Avenue Super Street and Olive Avenue Emphasis
East-West Mobility Study

AREA CONNECTIVITY ISSUES:

The east-west arterial network in the area covered by the East/West Mobility Study is subject to a number of significant gaps. In the western portion of the area, there are gaps along Peoria Avenue, Cactus Road and Thunderbird Road. Only two of the five east-west arterials in the study area are continuous and these are clustered at the southern boundary. In fact, there is not a continuous east-west arterial for a distance of five miles between Olive Avenue and Bell Road, which is two miles north of the study area boundary. The discontinuous street network of Sun City largely creates these gaps. The lack of continuous roadways represents a major problem for east-west traffic flow in the study area and places a major burden on Grand Avenue to serve east-west movements indirectly. The study area is also influenced by the fact that the discontinuous street network of Sun City West interrupts east-west arterials such as Union Hills Drive, Beardsley Road and Deer Valley Road. There is no continuous facility for four miles to north of Bell Road, where the future Loop 303 will eventually provide an east-west connection. Thus, improvements to Grand Avenue and the construction of Loop 303 will be critical to providing some relief to the east-west traffic flow problems in the study area.

None of the strategy packages propose construction of new roadway segments to make Peoria Avenue, Cactus Road or Thunderbird Road continuous in the western part of the study area. Historically, closing these gaps has been viewed as having too great an impact on existing neighborhoods.

In the eastern portion of the study area, discontinuities in the east-west network also occur. Gaps are present along Peoria Avenue, Cactus Road and Olive/Dunlap Avenue. Thunderbird Road swings in a southeasterly direction to link up with Cactus near the eastern boundary of the study area. Olive/Dunlap Avenue connects with Cave Creek Road, which subsequently leaves the study area in a northeasterly direction. Northern Avenue tees into SR 51. As in the western part of the study area, none of the strategy packages propose construction of new roadway segments to close gaps occurring along the arterials in the eastern part of the study area. Terrain and preservation of park areas represent major barriers to providing continuous facilities.

DEVELOPING AREA NEEDS

Within the 2020 timeframe of the East/West Mobility Study, the portion of the study area generally west of the Agua Fria River is not being projected to experience significant congestion. However, this area will be experiencing major growth in the future and extensive additional transportation infrastructure will be required. In order to recognize these needs, **Figure 10** depicts improvements on roadways not addressed in the strategy packages.

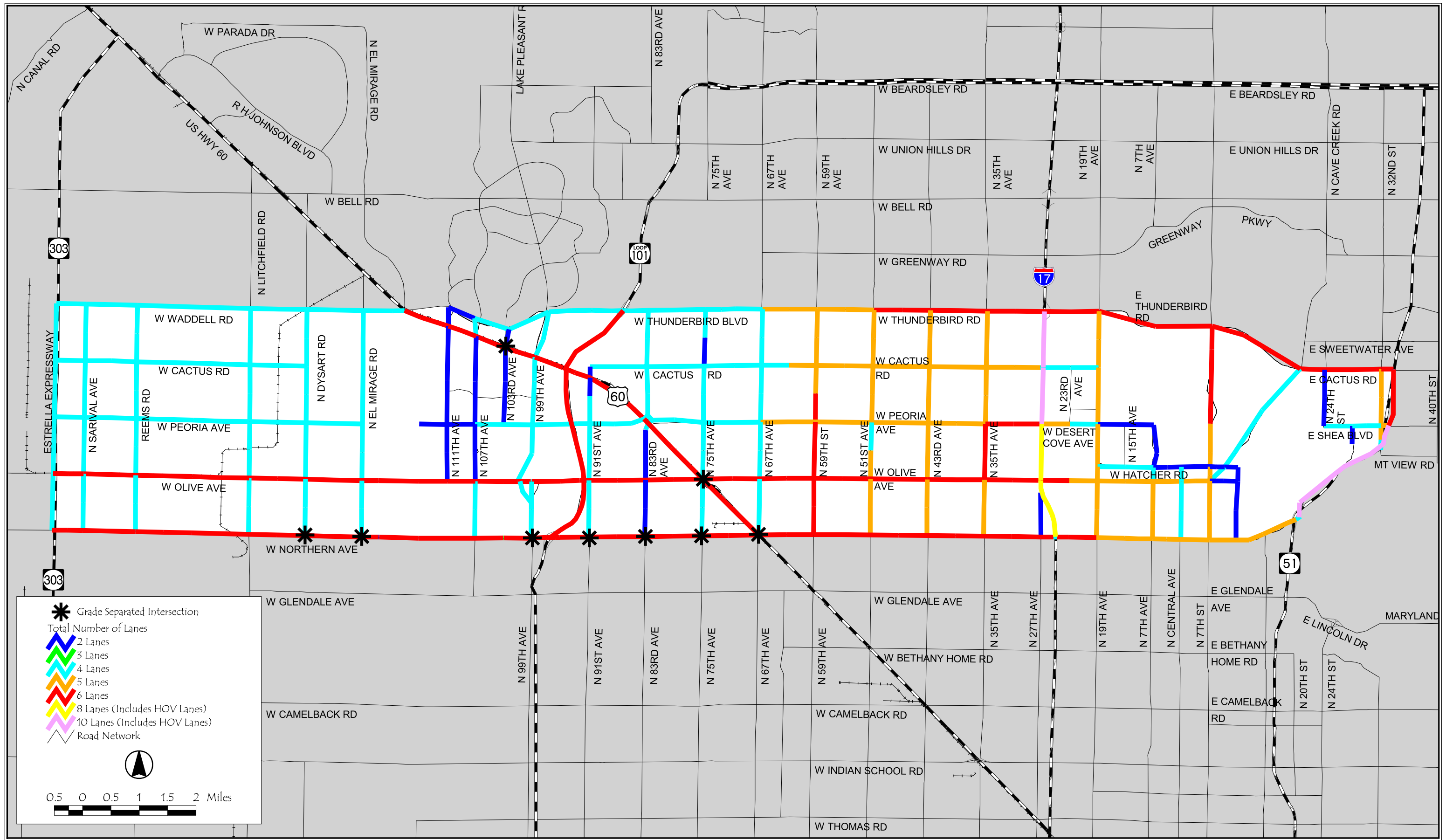
These suggested roadway improvements, which are identified in local jurisdiction plans, are listed below.

- Sarival Avenue from Waddell Road to Northern Avenue
- Reems Road from Waddell Road to Northern Avenue
- Litchfield Road from Waddell Road to Northern Avenue
- Dysart Road from Waddell Road to Northern Avenue
- El Mirage Road from Waddell Road to Northern Avenue
- Cactus Road from Loop 303 to Dysart Road
- Peoria Avenue from Loop 303 to El Mirage Road

The above transportation improvements would be to upgrade the facilities from a two-lane collector type facility to a four-lane minor or major arterial facility. The sources of these transportation improvements are from the following documents: City of El Mirage Circulation Plan, City of Surprise Future Transportation System Plan, and the Glendale Transportation System Plan. The timing of these needs will depend on how growth progresses in the west part of the study area. The phasing of growth in this area, and throughout the region, is being assessed as new population and employment projections are developed by MAG, in cooperation with its member jurisdictions. It is anticipated that these new projections will be adopted in fall 2002.

POTENTIAL FUTURE ROADWAY SYSTEM

A map showing the combined results of the roadway improvements identified in all of the strategy packages is provided in **Figure 11**.



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FIGURE 11
Potential Future Roadway System
East-West Mobility Study